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Synopsis of Proposed Research Plan

"Studies of Diversity and physiological behaviors of birds from Gerumatargaon dam and Paldhag dam focus to Dnyanganga wildlife sanctuary."

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1. Introduction

In both terrestrial and aquatic ecosystems, the bird population is a sensitive indication of pollution [1,2]. Estimating local avifauna densities aids in understanding the relative abundances of different species of other organisms [3]. In order to detect potential effects of industrial interference on ecosystems, birds are frequently utilized as pollutant monitors. Noise pollution in metropolitan areas irritated birds physically and interfered with their regular physiological functions [4]. Because different niche requirements exist, an assemblage of numerous and diverse bird species is a sign that there is less competition between species. Some birds are sensitive to noise or traffic, which causes disturbances to their movements in those circumstances. They serve as an early warning system and are one of the finest indicators of issues with ecology, human health, and pollution [5]. The significant habitat variety for birds may be seen in Maharashtra's Western Ghats.

1.1 Birds

In the order Aves, there are around 9,600 different species of warm-blooded, beaked vertebrates. Birds are the only animals in existence that are characterized by having a coating of feathers. A bird's egg has a calcium-rich shell because birds have four-chambered hearts (like mammals), wing-like forelimbs, excellent eyesight, and a specialized adaptation that allows them to fly. They have a weak sense of smell. Many different species of birds inhabit a wide variety of land and sea environments. There is a wide range of variety in nesting behavior and dietary preferences. The majority of bird species hold their eggs at a constant temperature. As a means of decreasing their overall mass, birds that take to the air have evolved skeletons with air gaps where some of the bone would normally be. Birds are able to eat while in the air thanks to an expanded portion of their esophagus called the crop. People consume both wild and domestic birds and their eggs, shoot wild birds for sport and

use feathers in a variety of ways, including as fashion accessories, household insulation, and in aircraft. In total, over a thousand ancient bird species have been recognized from fossils, with Archaeopteryx being the earliest fossil bird to be discovered. Bird research has made important theoretical and applied contributions to the biological sciences. Darwin's theory of evolution by natural selection owes much to his observations of Galapagos finches and other birds during the HMS Beagle voyage. Birds are one of the most well-recognized groups of animals, making museum collections of birds a vital resource for zoogeographic, geographical variation, and speciation study. The domestic chicken was a key model organism in the early stages of genetics and embryology. Research on birds by Konrad Lorenz, Nikolaas Tinbergen, and others laid the groundwork for the science of animal behavior (ethology). The effects of hormones on behavior and physiology, as well as the study of migration, have largely been conducted in birds [6].

Figure 1. A bird

1.2 Behavior

To a large extent, birds rely on reflexes, acting instantly in response to preprogrammed cues such as sounds or sights. Some of their feeding and reproduction habits are also very standard. Care for feathers is essential for keeping the wings and tail in flying condition and the remainder of the feathers in place, where they can act as insulation. As a result, skills like preening, oiling, shaking, and stretching are highly developed and frequently employed. The stretching of one wing, one leg, and half the tail (all on the same side) is a common, if not ubiquitous, behavior among birds. Shaking the entire body, usually starting at the rear, and stretching both wings upward (either folded or spread) are also common behaviors. The

act of washing oneself, whether in water or dust, has given rise to other movements. Such reassuring gestures are now commonly included as part of performance rituals.

As can be observed in the separation of a flock of swallows perched on a wire, many species of birds prefer to keep at least some distance from one another. Most species, during mating season, defend territories that can be anything from a few square feet around the nest to hundreds of square feet where the pair not only nests but actively forages. In reality, fights happen much less often when people engage in ritualized demonstrations of threat and appeasement. Some birds are strictly solitary, like several species of raptors, while others, like the guanay cormorants that live in the Peru Current off the west coast of South America, nest in massive colonies of hundreds of thousands and eat in vast flocks with boobies and pelicans, are extremely social.

Chemical messengers like hormones have a profound influence on biology and psychology. When released into circulation, they can have a multiplicity of effects on various organs and systems, including the brain. This suggests that differences in hormone levels in the blood could account for observed behavioral and physiological differences between avifauna. Individual differences in hormone concentrations have been attempted to be linked to differences in behavior, but these attempts have typically failed [7,8].

2. Statement of the problem

Thousands of different substances (plastic) and items of machinery (mobile phones) are used every day by humans all around the globe. The waste products or tissues of carcasses discharged into the environment still contain many of these non-degradable substances that are partially converted to inert chemicals. Non- degradable substances used by humans that are excreted make their way into wastewater treatment facilities (WWTPs) [9]. They can then be ingested by the invertebrates that reside atop the trickling filters used for secondary treatment here [10]. As a result, there is a possibility that animals like birds [11] and bats that forage near to WWTPs could be exposed to toxic materials, which cause changes in their physiological behavior and leads to hazardous outcomes.

3. Review of literature

Bopinwar et al., 2012 compared the variety of the avifauna in winter and summer seasons in a few Western Ghats locales in Maharashtra. Four sites saw 50 distinct bird species in total, of which 30 and 46 species, respectively, were seen in the winter and summer. There were 26 species that were prevalent during both research times. In comparison to sites A and B, site C had a much higher species diversity over both seasons. While tiny cormorant, purple sunbird, and red-vented bulbul outweighed others in summer, house sparrow and Indian myna were most prevalent during the winter. Fructivores and piscivores birds were the next most common bird behaviors after insectivores. According to the habitat index, the house crow came in second place, followed by the Indian myna and red-whiskered bulbul in the winter and summer, respectively [12].

Bean et al., 2014 given fluoxetine (FLUOX), a common antidepressant, or a placebo via food to wild-caught starlings (*Sturnus vulgaris*) for 22 weeks over the winter. Corticosterone (CORT) metabolite concentrations in feces varied depending on how well controls and FLUOX birds adapted to isolation**.** Boldness explored ion, and activity levels did not indicate any treatment effects. By day 2 of isolation, the controls who had higher levels of CORT metabolite excretion on day one had lost more body mass index than the controls who had lower levels. In FLUOX birds, mass loss and CORT metabolites were unrelated. They discovered that the controls visited the food trays more frequently than the FLUOX birds around the critical scavenging times of sunset and sunrise, which is ideal for birds of winter when they looked into the actions of the birds in their group aviaries. Despite the difficulty in interpreting the sub-lethal endpoints tested due to individual heterogeneity, data show that at environmentally relevant doses, fluoxetine can substantially change physiology and behavior [13].

Tarjuelo et al., 2015 investigated the physiological health and behavior of a near-threatened nongame steppe bird, the small bustard, in relation to human activities, particularly hunting. They compared, using a semi-experimental method, the following: 1) the kind and level of human activity; 2) human behavior; and 3) physiological stress (fecal corticosterone metabolites) of wintering birds before, during, and after weekends. Weekends saw higher levels of human activity, particularly connected to hunting, which indirectly disturbed bird

populations. Little bustards spent more time flying and remaining alert on weekends than throughout the week. They also spent more time foraging in the mornings after weekends, perhaps to make up for their higher energy use. They also discovered higher fecal glucocorticoid metabolite concentrations on weekends, which indicated elevated physiological stress levels. The highest degrees of disruptions connected to hunting were correlated with elevated corticosterone metabolite levels. Little bustard exhibited pronounced behavioral and physiological responses to human activities, especially hunting, which peaked on weekends. This particular activity, which takes place on weekends from autumn through winter, may have a long-term negative influence on the nongame populations of this endangered species, thereby negating any conservation efforts made to protect both domestic and international breeding populations [14].

Gormally et al., 2018 found out how recurrent exposure to acute stresses affects the body's physiology and behavior. House sparrows (*Passer domesticus*) were subjected to a chronic stress treatment in these repeated measures investigation. Before, during, and after the program, they measured many physiological and behavioral factors. The function of the hypothalamic-pituitary-adrenal (HPA) axis was evaluated in four ways using blood samples: stress-induced corticosterone, negative feedback, baseline corticosterone, and the maximum capacity to release corticosterone. Additionally, they evaluated the ability to destroy germs and variations in uric acid content. The protocol's behavioral changes were monitored using neophobia trials. None of the four features they evaluated for substantial changes in the control of the HPA axis. After only four days of treatment of the chronic stress, they discovered that uric acid levels and neophobia considerably declined, although bacterial killing capacity didn't start to decline until eight days had passed. These findings suggest that various stress response elements can be affected by chronic stress on various timelines. The findings also highlight the significance of examining a variety of physiologic and behavioral factors in order to comprehend how chronic stress exposure may affect an individual's capacity to handle new difficulties [15].

Kluen et al., 2014 stated that for the purpose of examining their covariance, these qualities must be jointly quantified. A small number of studies have found connections between a person's personality and their immune system. In this study, 592 blue tits that were collected

in the wild had their tarsus length, activity, handling aggression, and respiration rate measured along with two immunological features. In order to quantify the individual consistency of each trait (201) and divide the covariances between the traits into individual and residual covariances, a multivariate mixed model was used. They discover that every behavioral characteristic is consistent on an individual basis, proving that both the physiological measurements and how these behaviors reflect adult blue tit personality are repeatable. They draw the conclusion that there isn't a common syndrome of individual level covariance between physiological features and personality in wild blue tits or that the effect sizes that such a syndrome creates are too small ($r < 0.03$) to detect. This is based on a published power study [16].

4. Aim and objective of the study

We may deduce from the above discussion that none of the research has been done in this area and on the physiological behavior of birds. The study aimed to compare the various physiological behaviors of birds and their diversity in Gerumatargaon dam and Paldhag dam, focusing on Dnyanganga wildlife sanctuary, dist. Buldana Maharashtra.

❖ Objective of Research/ Proposed hypothesis

1. Identify the diversity of birds in Gerumatargaon dam and Paldhag dam
2. Characterization of physiological behaviors of birds On the basis of
    I. Hematological Parameters-
        a) hematocrit level(Hct)
        b) Hemoglobin level (Hb)
        c) Red Blood Cell (RBC)
        d) White Blood Cell (WBC)
    II. Harmonal Analysis
        a) Corticosterone Metabolite
        b) Catecholamines
        c) Cortisol
3. Compare the above physiological behaviors of birds in Gerumatargaon dam and Paldhag dam

5. Hypothesis

5.1 Null hypothesis

H01: Human-caused disturbances had an impact on birds' behavior and physiological stress.

H02: Environmental contamination has a significant impact on the levels of corticosterone metabolites.

H03: Low hematocrit level has a significant impact on the reduction of body mass index.

5.2 Alternate hypothesis

HA1: The behavior and physiological stress of birds were unaffected by human-caused disturbances.

HA2: Environmental contamination has no significant impact on the levels of corticosterone metabolites.

HA3: Low hematocrit level has no significant impact on the reduction of body mass index.

6. Methodology to be adobted

6.1 Study area

Within a Special Protection Area, this investigation will be conducted at the Gerumatargaon and Paldhag dams (Dnyanganga Wildlife Sanctuary, district of Buldana, Maharashtra). The region has been identified as a bird hotspot and is home to a sizeable number of little bustards that breed. During the fall and winter, as wintering birds arrive, the bird's population grows.

6.2 Sampling design

In 2022-2023, winter and summer seasons will be used to conduct field observations of the avifauna in the research area. The research area's length was measured using the vehicle's milometer. The 7x-15x35 Optima Zenith binocular will be used for direct observation of the birds, and the available literature will be used to identify them. The first place where the bird will find it will be counted, and care will take to avoid counting the same bird twice. The birds' call notes will utilize to identify them. The species checklist will be created using the available sources. The data will give a thorough study, and the following indices will be used:

1. Dominance Index (D) D= (ni /N) x 100.
2. Census Index (C) C = ni/M.
3. Species Richness Index, it is expressed as total number of species recorded at each region.
4. Species Diversity Index (d) (Margalef 1951) d = (S-1) In N.
   Where ni=counts of individual species recorded; N=total counts of all species; M=area in Km^2 Covered at each region; S=total number of species recorded
5. Habitat index: The two most important factors to consider when assessing a bird's habitat in a natural ecosystem are preference and availability. These will be calculate using the abundance and regularity of the birds at several sampling locations over the course of two seasons. The frequency measurement shows how frequently a species occurs at each sampling point, while the density measurement shows how many individuals were present at each sampling point. The habitat index, which is a useful metric to evaluate a species' overall value, is the mean of these two factors.

6.3 Birds' behavior

Two readings will be recorded in the winter of 2022, morning and afternoon observations. We will measure the behavior using behavioral scans [17]. We will additionally note the day, the hour, and the total flock size. In order to sample the behavior of at least 18 individuals (birds) in each scan, we will do several scan samplings on various groups of individuals (birds) within big flocks with a 2-min gap between each scan.

6.4 Physiological traits: sample collection

We will obtain fecal samples from that sizable roost during the 2 experiments carried out in the winter of 2022 at 3 times: before, during, and after the weekend in order to calculate the concentrations of fecal glucocorticoid metabolites. When delivered to the lab (less than 1 hour after collection), each fecal sample will be kept separately in a labeled plastic bag and chilled. There, it will be frozen at 20 °C until it is analyzed. Quantification of human activities and surveys of flocks will be carried out for 11 trials. Additionally, we will assess how exposure to the environment affects the levels of corticosterone metabolites in feces.

The ratio of red blood cells to total blood volume will be measured by the hematocrit value (i.e., blood cell and plasma volume). The blood's ability to absorb oxygen is significantly influenced by red blood cells. A bird's condition can be determined by looking at its hematocrit level. Low hematocrit (anemia) readings can signify bacterial illness, parasitism, or malnutrition. Blood will typically be sampled only once per individual per season (the first time caught). Before further analysis, blood samples will be placed in heparinized hematocrit capillary tubes, sealed with wax on one side, and maintained in a cold bag.

6.5 Statistical analysis

The statistician will assess the organized proforma in which all data will be recorded. At the conclusion of the research, data will be analyzed using the relevant statistical techniques.

7. Importance of Study/ Society application

➢ National Status

- There are estimated to be around 1200 different species of birds in India. As on date, there is no formal effort from the government of India to ascertain the numbers relating to the avian species in India.
- Over the past two to three decades, there are apprehensions about the fall in bird numbers due to anthropogenic and other factors. However, apart from isolated observations, there has been no cohesive effort in this direction. In this context, State of India's Birds Report -2020 comes as a welcome step towards monitoring and conservation of bird species in India. This report is the result of a combined effort and partnership of 10 different organizations.It was released on 17 February 2020 at the 13th Conference of Parties to the Convention on Migratory Species. This was held in Gandhinagar, Gujarat.

➢ International Status

- Birds have always been among the best-studied biological groups, in part because of the efforts of countless amateur birdwatchers. In 2003 the World Conservation Union (IUCN) reported that 129 bird species have gone extinct, with another four species extinct in the wild. The rate of extinction among birds has increased every fifty years. Bird species have died out because of habitat destruction, hunting and collection, pollution, and predation by non-native species. The extinction rate of bird species is alarming not only because of the irrevocable loss of each species but also because of implications for the health of entire ecosystems.

- The United States government has long recognized the importance of bird biodiversity and promoted habitat conservation under the Migratory Bird Conservation Act, passed by Congress in 1929. This law established the Migratory Bird Conservation Commission, which works with the Secretary of the Interior to designate and fund avian wildlife refuge areas. The U.S. Fish and Wildlife Service is responsible for acquiring necessary lands through direct purchase, lease, or easement (agreement with landowners). The Fish and Wildlife Service has procured over 4 million acres of land for bird refuges.

- Birds received considerable attention in the 2003 IUCN Red List of Threatened Species. A total of 1,194 bird species were considered threatened—one of every eight described species. Another 727 bird species were considered "near threatened." There were 182 bird species categorized as "critically endangered," a significant increase from 168 listed species only seven years earlier. Of these critically endangered species, a large majority—89 percent—have been harmed by loss of habitat. The number of "endangered" birds listed by the IUCN also increased dramatically, from 235 to 331 species.

8. Proposed workplan- with tentative chapter scheme/ Formulation and structure of study

The Topic of thesis will be

- Identification and diversity of birds
- Characterization of physiological behaviors
- Hematological Parameters
- Harmonal Analysis
- Comparision of physiological behaviors from the dams

Year wise plan of work and Targets to be achieved

First Year- Introduction, Course work, Review of literature, Referencing, books and Methodology, Visit to various localities of Gerumatargaon dam and Paldhag dam.

Second year- conduct field observations of the avifauna in the research area, obtain fecal samples from that sizable roost, collect blood samples from injured birds measure the behavior using behavioral scans, Statistical analysis.

Third year- Summery, conclusion, bibliography, documentation, analysis of result, writing, typing and submission of thesis

9. Expected Outcomes:-

- The behavior and physiological stress of birds were unaffected by human-caused disturbances.
- Environmental contamination has no significant impact on the levels of corticosterone metabolites.
- Low hematocrit level has no significant impact on the reduction of body mass index.

References

1. Gaston AJ. Methods for estimating bird populations.
2. Hardy AR, Stanley PI, Greig-Smith PW. Birds as indicators of the intensity of use of agricultural pesticides in the UK. The Value of Birds. 1987;11:9-132.
3. Turner WR. Citywide biological monitoring as a tool for ecology and conservation in urban landscapes: the case of the Tucson Bird Count. Landscape and Urban Planning. 2003 Oct 15;65(3):149-66.
4. RAMASWAMY G, SELVAN KM, SIVAPERUMAN C. DIVERSITY AND SPECIES ABUNDANCE OF BIRD COMMUNITIES IN DIFFERENT HABITATS IN THE SOUTHERN WESTERN GHATS. c. Raghunathan. 2012;381:381.
5. CRUZ O, ILIZALITURRI CA, de Jesús MEJÍA J, ESPINOSA G, ALFARO MC, GONZÁLEZ DJ. EVALUACIÓN PRELIMINAR DE BIOMARCADORES ENZIMÁTICOS EN.
6. King D, Finch DM. The effects of climate change on terrestrial birds of North America. Washington, DC: US Department of Agriculture, Forest Service, Climate Change Resource Center. Online: http://www. fs. fed. us/ccrc/topics/wildlife/birds/. 2013.
7. Crews D. On the organization of individual differences in sexual behavior. American Zoologist. 1998 Feb 1;38(1):118-32.
8. Adkins-Regan E. Hormones and animal social behavior. In Hormones and Animal Social Behavior 2013 Dec 3. Princeton University Press.
9. Monteiro SC, Boxall A. Occurrence and fate of human pharmaceuticals in the environment. Reviews of environmental contamination and toxicology. 2010:53-154.
10. Markman S, Guschina IA, Barnsley S, Buchanan KL, Pascoe D, Müller CT. Endocrine disrupting chemicals accumulate in earthworms exposed to sewage effluent. Chemosphere. 2007 Nov 1;70(1):119-25.
11. Fuller RJ, Glue DE. Sewage works as bird habitats in Britain. Biological Conservation. 1980 Apr 1;17(3):165-81.
12. Bopinwar SS, Meshram DB, Bharati MT, Paunikar WN, Ghosh TK. Diversity of birds in some ecological niches of Western Ghats in Maharashtra (India).
13. Bean TG, Boxall AB, Lane J, Herborn KA, Pietravalle S, Arnold KE. Behavioural and physiological responses of birds to environmentally relevant concentrations of an antidepressant. Philosophical Transactions of the Royal Society B: Biological Sciences. 2014 Nov 19;369(1656):20130575.
14. Tarjuelo R, Barja I, Morales MB, Traba J, Benítez-López A, Casas F, Arroyo B, Delgado MP, Mougeot F. Effects of human activity on physiological and behavioral responses of an endangered steppe bird. Behavioral Ecology. 2015 May 1;26(3):828-38.
15. Gormally BM, Wright-Lichter J, Reed JM, Romero LM. Physiological and behavioral responses of house sparrows to repeated stressors. PeerJ. 2018 Jun 6;6:e4961.
16. Kluen E, Siitari H, Brommer JE. Testing for between individual correlations of personality and physiological traits in a wild bird. Behavioral Ecology and Sociobiology. 2014 Feb;68(2):205-13.
17. Bateson M, Martin P. Measuring behaviour: an introductory guide. Cambridge university press; 2021 May 6.

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Research Guide